

AMENDMENT OF THE CLAIMS

1. (currently amended) A system for protecting an electric motor (1) and its control circuit (2),

the control circuit (2) comprising a set of switches (Ch) to control the speed of the motor (1),

the system being characterized by:

comprising a control central (7) connected to the control circuit (2), the ~~central~~ control central (7) being capable of measuring an electricity conduction time (T_c) of each of the switches (Ch) and to measure a time (T_d) passed between the beginning of the conduction of one of the switches (Ch) and the occurrence of a surge current, the surge being measured by means of a surge detector (3) which compares the value of a current (I_{RS}) that flows through the control circuit (2) to a predetermined current (I_{LIMIT}) value,

the control central (7) making a comparison between the times (T_d , T_c) and being capable of determining whether the surge current results from an overload or from a short-circuit on the electric motor (1) or any of the switches (Ch).

2. (currently amended) A system according to claim 1, characterized in that the control central (7) indicates a condition of short-circuit of the motor (1) or on one of the switches (Ch) when the time (T_d) is shorter than the time (T_c) multiplied by a factor (k) that ranges from 0 to 1, and the control central (7) indicates a condition of surge overload of the motor (1) when the time (T_d) is longer than the time (T_c) multiplied by the factor (k).

3. (original) A system according to claim 2, characterized in that the factor (k) is equal to 0.5.

4. (currently amended) A method for protecting an electric motor (1) and its circuit (2), the speed control of the motor (1) being carried out by means of a set of switches (Ch), the method being characterized by comprising the steps of:

measuring an electricity conduction time (T_c) of each of the switches (Ch),

measuring a time (T_d) passed between the beginning of conduction of one of the switches (Ch) and the occurrence of a surge, and

comparing the times (T_d , T_c) and consequently determining whether the surge current results from an overload or from a short-circuit of the electric motor (1) or on any of the switches (Ch).

5. (currently amended) A method according to claim 4, characterized in that, in the comparison step, a condition of short-circuit of the motor (1) or on one of the switches (Ch) is indicated when the time (T_d) is shorter than the time (T_c) multiplied by a factor (k) that ranges from 0 to 1, and an overload condition of the motor (1) is indicated when the time (T_d) is longer than the time (T_c) multiplied by the factor (k).

6. (original) A method according to claim 5, characterized in that, in the comparison step the factor (k) is equal to 0.5.

7. (currently amended) An electric motor (1) having phases (F),

the phases (F) being fed by a set of switches (Ch), and

the switches (Ch) being controlled by a control circuit (2) to modulate a voltage that is applied to the phases (F) to control the speed of the motor (1),

the motor (1) being characterized in that the control of the switches (Ch) is carried out by a control central (7) connected to the control circuit (2),

the control central (7) being capable of measuring the electricity conduction time (T_c) of each of the switches (Ch) and to measure the time (T_d) passed between the beginning of conduction of one of the switches (Ch) and the occurrence of a surge current,

the surge being a value of a current (I_{RS}) that flows through the phases (F) higher than a predetermined current (I_{LIMIT}) value,

the control central (7) making a comparison between the times (T_d , T_c) and being capable of determining whether the surge current results from an overload or from a short-circuit of the phases (F) of the electric motor (1) or any of the switches (Ch).

8. (currently amended) A motor according to claim 7, characterized in that the control central (7) indicates a condition of short-circuit of the motor (1) when the time (T_d) is shorter than the time (T_c) multiplied by a factor (k) that varies between 0 and 1, and the control central (7) indicates a condition of overload of the motor (1) when the time (T_d) is longer than the time (T_c) multiplied by the factor (k).

9. (original) A motor according to claim 8, characterized in that the factor (k) is equal to 0.5.

10. (new) A protection system for protecting a control circuit of an electric motor and protecting the electric motor,

the control circuit comprising a set of switches to control the speed of the motor,

the system comprising a control central connected to the control circuit, the control central selectively commanding the switches,

the control central measuring an electricity conduction time (T_c) of each of the switches and measuring a disturbance time (T_d) passed between the beginning of the conduction of one of the switches and the occurrence of a surge current, the surge being measured by means of a surge detector which compares the value of a current (I_{RS}) that flows through the control circuit to a predetermined current (I_{LIMIT}) value,

the control central making a comparison between said the disturbance time (T_d) and the conduction time (T_c) to determine whether the surge current results from an overload or from a short-circuit on the electric motor or any of the switches.

11. (new) A system according to claim 10, wherein the control central indicates a condition of short-circuit of the motor or on one of the switches when the disturbance time (T_d) is shorter than the conduction time (T_c) multiplied by a factor (k) that ranges from 0 to 1, the control central indicating a condition of overload of the motor when the disturbance time (T_d) is longer than the conduction time (T_c) multiplied by said factor (k).

12. (new) A system according to claim 2, wherein said factor (k) is equal to 0.5.

13. (new) A method for protecting a control circuit of an electric motor and protecting the electric motor,

the speed control of the motor being carried out by selectively commanding a set of switches,

the method comprising the steps of:

measuring an electricity conduction time (T_c) of each of the switches,
measuring the disturbance time (T_d) passed between the beginning of conduction
of one of the switches and the occurrence of a surge,
comparing the disturbance time (T_d) with the conduction time (T_c).

14. (new) A method according to claim 13, wherein, in said comparison step, a condition
of short-circuit of the motor or on one of the switches is indicated when the disturbance
time (T_d) is shorter than the conduction time (T_c) multiplied by a factor (k) that ranges
from 0 to 1, and an overload condition of the motor (1) is indicated when the disturbance
time (T_d) is longer than the conduction time (T_c) multiplied by said factor (k).

15. (new) A method according to claim 14, wherein, in said comparison step said factor
(k) is equal to 0.5.

16. (new) An electric motor having phases,
said phases being fed by a set of switches,
said switches being controlled by a control circuit to modulate a voltage that is
applied to said phases to control the speed of the motor,
wherein the control of the switches is carried out by a control central connected to
the control circuit,
the control central measures the electricity conduction time (T_c) of each of the
switches and measures the disturbance time (T_d) passed between the beginning of
conduction of one of the switches (~~Ch~~) and the occurrence of a surge current,
the surge being a value of a current (I_{RS}) that flows through the phases higher than
a predetermined current (I_{LIMIT}) value,

the control central making a comparison between the disturbance time (T_d) and the conduction time (T_c) to determine whether the surge current results from an overload or from a short-circuit of the phases of the electric motor or any of the switches.

17. (new) A motor according to claim 16, wherein the control central (7) indicates a condition of short-circuit of the motor when the disturbance time (T_d) is shorter than the conduction time (T_c) multiplied by a factor (k) that varies between 0 and 1, the central indicating a condition of overload of the motor when the disturbance time (T_d) is longer than the conduction time (T_c) multiplied by said factor (k).

18. (new) A motor according to claim 9, wherein said factor (k) is equal to 0.5.